

CLAIMS

1. A method for preparing a nanofiltration membrane, wherein:

5 - the starting point is a porous membrane (3,9), a so-called supporting membrane, having at least one face, a so-called grafting face (12,30), having filtration properties in the range defined by microfiltration or ultrafiltration and, at least on this grafting face, at least one agent, a so-called photosensitive agent, capable of generating free radicals when it is subjected to light radiation,

10 - the grafting face (12,30) is put in the presence of:

15 . a grafting composition containing at least one monomer, a so-called grafting monomer, capable of forming at least one polymer by radical polymerisation, and at least one crosslinking agent adapted so as to bring about crosslinking of at least one polymer formed by radical polymerisation, the molar quantity of crosslinking agent(s) being less than that of the grafting monomer(s) in the composition, this

20 grafting composition being free from a photoinitiating agent,

25 . light radiation capable of activating the formation of free radicals by the photosensitive agent of the supporting membrane (3,9) in the absence of a photoinitiating agent in the grafting composition, during a predetermined period, adapted as a function of the characteristics of the light radiation so as to obtain the nanofiltration properties of the membrane.

2023-02-20 14:57:00

2. The method as claimed in claim 1, wherein the supporting membrane (3,9) is a mesoporous ultrafiltration membrane with a permeability of between 5.10^{-4} and $10^{-2} \text{ } \ell \cdot \text{h}^{-1} \cdot \text{m}^{-2} \cdot \text{Pa}^{-1}$, in particular between 10^{-3} and $6.10^{-3} \text{ } \ell \cdot \text{h}^{-1} \cdot \text{m}^{-2} \cdot \text{Pa}^{-1}$.

5 3. The method as claimed in either of claims 1 or 2, wherein the supporting membrane (3,9) contains at least one photosensitive agent chosen from the group formed of polysulfones and their derivatives - in particular polysulfone, (polymethylsulfone), polyaryl sulfones and 10 polyethersulfone - aromatic polyketones, polyphenylene oxides, aromatic polyimides, polyetherketones, and copolymers and mixtures of polymers containing at least one photosensitive agent chosen from the group formed of polysulfones or of their derivatives, aromatic polyketones, polyphenylene oxides, aromatic polyimides and 15 polyetherketones.

4. The method as claimed in one of claims 1 to 3, wherein the supporting membrane (3,9) consists substantially of at least one photosensitive polymer.

20 5. The method as claimed in claim 4, wherein the photosensitive polymer is chosen from the group formed of polysulfones and their derivatives - in particular polysulfone, (polymethylsulfone), polyaryl sulfones and polyethersulfone - aromatic polyketones, polyphenylene 25 oxides, aromatic polyimides, polyetherketones, and copolymers and mixtures of polymers containing at least one photosensitive agent chosen from the group formed of polysulfones or of their derivatives, aromatic polyketones, polyphenylene oxides, aromatic polyimides and 30 polyetherketones.

6. The method as claimed in one of claims 1 to 5, wherein the grafting composition contains at least one grafting

EPO/2012/00000000000000000000000000000000

monomer containing in its formula at least one unsaturated covalent bond, in particular at least one carbon-carbon double bond, and at least one crosslinking agent including in its formula at least two unsaturated covalent bonds, in particular at least two carbon-carbon double bonds.

7. The method as claimed in one of claims 1 to 6, wherein the grafting composition contains at least one vinyl grafting monomer.

8. The method as claimed in one of claims 1 to 7, wherein 10 the grafting composition contains at least one grafting monomer chosen from the group comprising acrylic acid; acrylamide; methacrylic acid and their acrylate, methacrylate and acrylamide derivatives; vinyl pyridines and their alkyl or carbazole derivatives; maleic anhydride; 15 vinyl acetates; vinyl sulfonic acid; vinyl phosphoric acid; 4-styrene sulfonic acid; N-vinyl pyrrolidone.

9. The method as claimed in one of claims 1 to 8, wherein 20 the grafting composition includes at least one crosslinking agent chosen from the group of acrylates, methacrylates and difunctional acrylamides.

10. The method as claimed in claim 9, wherein the grafting composition includes at least one crosslinking agent chosen from the following group of compounds: triallyl 25 isocyanurate; triallyl cyanurate; 1,5-hexadiene-3-ol; 2,5-dimethyl-1,5-hexadiene; 1,5-hexadiene; 1,7-octadiene; 3,7-dimethyl-2,6-octadiene-1-ol; divinylbenzene; tetraethylene glycol diacrylate; polyethylene glycol dimethacrylate; methylene bisacrylamide.

30 11. The method as claimed in one of claims 1 to 10, wherein light radiation is applied with a wavelength or wavelengths

of between 200 nm and 600 nm, so as to deliver light energy of between 0.1 J/cm² and 300 J/cm², preferably between 0.7 and 160 J/cm².

12. The method as claimed in one of claims 1 to 11, wherein
5 the supporting membrane (3,9) and the grafting monomer(s) of
the grafting composition are chosen such that the
photosensitive agent(s) has/have an absorption spectrum in a
wavelength region where the grafting monomer(s) has/have
substantially no absorption, and light radiation is chosen
10 that does not emit outside this region.

13. The method as claimed in one of claims 1 to 12, wherein
light radiation is applied with a wavelength or wavelengths
situated outside the absorption region of the grafting
monomer(s) of the grafting composition.

15 14. The method as claimed in one of claims 1 to 13, wherein
light radiation is applied with a wavelength or wavelengths
above 300 nm.

15. The method as claimed in one of claims 1 to 14, wherein
an ultraviolet lamp (5,11) is used surrounded by a glass
20 tube capable of filtering out wavelengths below 300 nm.

16. The method as claimed in one of claims 1 to 15, wherein
the grafting composition contains between 1% and 10% by
mass, in particular of the order of 2.5% by mass, of a
grafting monomer or monomers.

25 17. The method as claimed in one of claims 1 to 16, wherein
the grafting composition contains a quantity of crosslinking
agent(s) of between 0,1 molar % and 10 molar % of the
quantity of grafting monomer.

30 18. The method as claimed in one of claims 1 to 17 wherein,
in order to put the grafting face (12,30) into the presence

of the grafting composition, the supporting membrane (3,9) is immersed in a bath (2,10) of the grafting composition in the form of a deoxygenated liquid solution.

19. The method as claimed in one of claims 1 to 18, wherein
5 light radiation is applied while the grafting face (12, 30)
is immersed in a bath (2, 10) of grafting composition.

20. The method as claimed in one of claims 1 to 19, wherein the grafting face (12, 30) is immersed in a bath of the grafting composition, is then withdrawn from this bath and
10 light radiation is then applied.

21. A nanofiltration membrane wherein it comprises:

- a porous membrane (3,9), a so-called supporting membrane, having at least one face, a so-called grafting face (12,30) having filtration properties in the range defined by microfiltration and ultrafiltration.

- a graft of at least one crosslinked polymer grafted onto the grafting face, this graft being adapted so as to confer nanofiltration properties on the grafting face.

22. The membrane as claimed in claim 21, wherein it has a
20 degree of retention of ionic inorganic species greater than
10% for a permeability greater than $10^{-6} \text{ l.h}^{-1} \cdot \text{m}^{-2} \cdot \text{Pa}^{-1}$, and
retains, at least substantially, these properties with time
and during use.

23. The membrane according to either of claims 21 or 22,
25 wherein the supporting membrane (3,9) is a microporous or
mesoporous membrane consisting substantially of at least one
polymer chosen from the group formed of polysulfones and
their derivatives - in particular polysulfone
(polymethylsulfone), polyarylsulfones and polyethersulfone -
30 aromatic polyketones, polyphenylene oxides, aromatic

polyimides, polyetherketones, and copolymers and mixtures of polymers containing at least one photosensitive agent chosen from the group formed of polysulfones or their derivatives, aromatic polyketones, polyphenylene oxides, aromatic
5 polyimides and polyetherketones.

24. The membrane as claimed in one of claims 21 to 23, wherein the graft of a crosslinked polymer or polymers is formed of at least one vinyl polymer.

10 25. The membrane as claimed in claim 24, wherein the graft of a crosslinked polymer or polymers is formed of at least one polyacrylic polymer.

26. The membrane as claimed in one of claims 21 to 25, wherein it is in the form of a hollow fibre.

20243702-D.02143342